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ABSTRACT

Interest is focused on the relationship between how old a person is when he or she first begins to learn a language and the fluency with which he or she can produce and understand that language in adulthood. The goal is to describe and measure the relationship between early experience and environment in language learning. In particular, the attempt is to better understand how sign language is learned in childhood and adulthood for both research and educational purposes. The discussion includes means and methods for distinguishing among special patterns of language learning: signed or spoken, first or second, typical, delayed, or disordered. Experiments designed to examine the relationship between the age at which people first learn to sign and their ability to repeat sentences in American Sign Language (ASL) were carried out. The results demonstrate that signers' ability to repeat ASL sentences depends, in part, upon the length of time they have used sign language and thus helps explain the great variation in production and comprehension skills among adult signers. (Author/JK)

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Sentence Repetition in American Sign Language

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In the United States, about 90% of deaf children have parents who hear normally (Schein and Delk, 1974). The figure suggests that most deaf adults who use sign language learned it for the first time from teachers or peers in classrooms and on playgrounds rather than at home around their parents' knees. Thus we are interested in the relationship between how old a person is when she first begins to learn a language and the fluency with which she can produce and understand that language in adulthood. Ideally we would like to describe and measure the relationship between early experience and environment in language learning. In particular, we want to understand better how sign language is learned in childhood and adulthood for both research and educational purposes. How can we distinguish among special patterns of language learning be it signed or spoken, first or second, typical, delayed or disordered? To explore the question, we designed some experiments to examine the relationship between the age at which people first learn to sign and their ability to repeat sentences in American Sign Language, ASL. Before we present and discuss the quantitative data from our first experiment, we will discuss briefly the research that led to our hypotheses. The results demonstrate that signers' ability to repeat ASL sentences depends, in part, upon the length of time they have used sign language and thus help explain the great variation in production and comprehension skills among adult signers.

Variation in Sign Language

Stokoe (1970) originally proposed that signers in the United States and parts of Canada used two dialects of sign language, one a public and the other a private dialect that signers used when they were alone among themselves. He called the situation "sign language diglossia". Ferguson (1959) first used the term "diglossia" to describe two varieties of the same language that speakers use in complementary social situations. Woodward (1973) and Woodward and Markowicz (1975) suggested that the variation in sign language Stokoe described was

akin to pidgin and creole languages. They proposed that one dialect of sign language was a pidgin language, a mix of sign language and English which they called "pidgin-sign English", or PSE. Later, Fischer (1978) also observed multiple linguistic and socioeconomic similarities between pidgin and creole languages and the relationship of pidgin-sign English to American Sign Language. Because pidgin languages are the product of second-language learning and creole languages are the product of first-language learning, there may be an intimate and complex relationship between the age at which a person first learns to sign and the linguistic structure in sign language that he can produce and understand as an adult.

Linguistic Structure

There is a growing list of linguistic structures that linguists have found to occur regularly in ASL, but not in PSE (Wilbur, 1979). The list includes inflections for verb aspect and number that are nested in the movements of signs (Fischer, 1973; Fischer and Gough, 1978; Klima and Bellugi, 1979). ASL uses inflections for nouns and verbs that also are nested in sign movement. In addition, ASL uses a complex set of classifiers (Supalla and Newport, 1978; Newport and Supalla, 1980; McDonald, 1981). Facial expressions and torso movements serve both linguistic and paralinguistic functions in ASL; the nonmanual signals mark phrases, clauses and sentences in ASL, but not in PSE (Baker and Padden, 1978; Liddell, 1978; Reilly and McIntire, 1980).

Age of Acquisition

Several researchers have observed that second-generation signers, that is, deaf signers whose parents are also deaf and sign, produce the above ASL morphology in their signing. Their parents usually do not if they are first-generation signers. First-generation signers are deaf people whose parents

hear normally and do not sign. Such a signer first learns to sign after infancy outside the home and typically produces a pidgin-sign language, PSE. The deaf children of first-generation signers see their parents use a pidgin-sign language, PSE, but produce a creole-sign language, ASL, instead. Fischer (1978) and Newport and Supalla (1980) have proposed that the differences in the linguistic structure between ASL and PSE reflect the age differences of their learners: Signers who first learn to sign as children produce ASL, but signers who first learn to sign as adults are more likely to produce PSE.

Fluency in Sign Language

Native and nonnative signers. Mayberry (1979) found measurable differences in ASL fluency among deaf signers similar to those of native and nonnative speakers. She asked native and nonnative signers to shadow ASL stories. Shadowing is a task much like simultaneous interpretation without the extra language. The signer repeats a message while simultaneously watching it. The native signers in Mayberry's study were all congenitally deaf adults who first learned to sign from their deaf parents, second-generation signers. The nonnative, or first generation, signers were all congenitally deaf adults who had normally hearing parents. Their first language was English and they all first learned to sign after 16 years of age.

Both the native and nonnative signers' shadowing accuracy was positively correlated with their ability to answer questions about the stories they shadowed. The native signers shadowed the ASL stories with greater accuracy than the nonnative signers. Much earlier, Treisman (1965) found that speakers who were equally fluent in English and French shadowed prose passages from both languages with equal accuracy. Speakers who were unequally fluent in English and French shadowed their native language with greater accuracy than they shadowed their nonnative or second language. More recently, Ringeling (1979) obtained similar results for speakers of Dutch who shadowed their native Dutch with greater accuracy than they shadowed their nonnative and second language, English.

ASL and PSE. Hatfield (1980) designed a study to determine the degree to which deaf signers show bilingual fluency in ASL and PSE. She presented ASL and PSE translations of sentences such as, "Birds can't fly" and "Ice is colder than water" to five groups of deaf signers. She measured the speed and accuracy with which they decided whether the ASL and PSE sentences were true or false. One group of signers had deaf parents from whom they learned to sign. They were native signers who also, as children, attended schools that used some form of manual communication in the classroom. The remaining groups of deaf signers all had normally hearing parents. Hatfield grouped the deaf signers with normally hearing parents according to the age at which they first began to sign (from birth, before 12 years, and after 15 years of age), whether their normally hearing parents signed or not, and whether or not they had attended schools that used manual communication in the classroom.

Hatfield (1980) found that the best single predictor of the signers' ASL skill was the age at which they first began to learn to sign. The best single predictor of the signers' PSE skill was whether they, as children, attended a school that used some form of manual communication in the classroom. The signers who had deaf parents and also attended schools that used manual communication in the classroom showed equal skill on the ASL and PSE sentences. Of the five groups of signers with normally hearing parents, four showed dominant skill on the PSE sentences. Only one group showed dominant skill on the ASL sentences. Their normally hearing parents did not sign; they first learned to sign before 12 years of age, but did not attend schools that used manual communication in the classroom until they were 15 years of age.¹ Hatfield's results demonstrate that deaf signers possess varying degrees of bilingual fluency in both ASL and PSE. Furthermore, her results demonstrate that signers' fluency in ASL and PSE is related to their childhood experience with each.

We were thus interested in exploring in greater detail the relationship between the age at which a person first learns to sign and her or his ability to repeat ASL sentences. In addition, we also wanted to compare behavioral measures of fluency in ASL.

Hypotheses. Based upon recent research, we proposed three hypotheses. First, the younger a person first learns to sign, the more accurately he will be able to repeat ASL sentences. Second, the younger a person first learns to sign, the more accurately he will be able to repeat grammatical-ASL sentences as compared to scrambled-ASL sentences. Third, the younger a person first learns to sign, the more accurately he will be able to simultaneously receive and repeat ASL sentences (shadowing) as compared to his ability to successively receive and repeat ASL sentences (recall).

Method

To test our hypotheses, we designed an experiment using a 4x2x2 repeated-measures design. The first independent variable was the age at which congenitally deaf, adult signers first began to learn to sign (from birth, from five years of age, between the ages of 13 and 15, and after 18 years of age). The second independent variable was syntactic structure, ASL sentences and scrambled-ASL sentences. The third independent variable was the task of repeating the utterances either while simultaneously watching them (shadowing), or after watching them (recall). The dependent measure was repetition accuracy.

Stimulus Utterances

Most of the ASL sentences we used Hatfield (1980) originally constructed for her sentence verification task. We used 32 ASL sentences which varied in length from 3 to 10 morphemes. The average length of the sentences was 6 morphemes. By morphemes we mean ASL inflections as well as base signs. Next we created 32 scrambled-ASL sentences by randomizing the order of the

signs within each of the sentences. When we randomized the order of the signs within the sentences, we kept the inflections with their original base signs. Then we mixed the ASL sentences and the scrambled-ASL sentences into two lists of 32 utterances each. Half of each list consisted of ASL sentences and the other half consisted of scrambled-ASL sentences. Within each list we randomized the presentation order of the sentences and scrambled sentences.

We videotaped the experiment's instructions, the practice utterances, and the two stimulus lists. A congenitally deaf, native-ASL signer signed all the stimulus utterances. He signed both the ASL sentences and the scrambled-ASL sentences with normal ASL phrasing patterns.²

Subjects

The 44 subjects were all congenitally deaf, young adults who were students and faculty at the National Technical Institute for the Deaf. They ranged in age from 20 to 38 years. We grouped the subjects in terms of the age at which they first began to learn sign language. The first group consisted of 12 subjects, 11 of whom had two deaf parents, and one who had normally hearing parents but who also had two, older deaf siblings. All the subjects in the first group were exposed to sign language from birth in their homes. The second group consisted of 9 subjects, all of whom had two normally hearing parents and first began to learn to sign at school when they were five years old. The third group consisted of 12 subjects, all of whom had two normally hearing parents and first began to learn to sign outside their homes between the ages of 13 and 15 years. The fourth group consisted of 11 subjects, all of whom had two normally hearing parents and first began to learn to sign after 18 years of age.

Procedure

We tested the subjects one at a time. After explaining the procedure, we showed the subjects the videotaped instructions after which they practiced either the shadowing or recall task with two sentences and two scrambled

sentences. If the subject had no questions, we proceeded with the first experimental task. When we showed the two lists of videotaped utterances to the subjects, we alternated the two lists with the two tasks so that all the subjects saw all the stimulus sentences and their scrambled counterparts and performed both the shadowing and the recall tasks. Half of the subjects performed the shadowing task followed by the recall task. The other half of the subjects performed the recall task first. We videotaped each subject's performance.

Data Analysis

Two congenitally deaf, ASL signers transcribed the subjects' videotaped performance.³ The transcribers noted how many and which signs and inflections in each ASL sentence and scrambled-ASL sentence each subject repeated accurately. They also recorded all the subjects' errors as omissions, substitutions, and additions. We then calculated the percentage of morphemes for each sentence and scrambled sentence that each subject repeated accurately. For the statistical analyses, three-way analysis of variance, we transformed the percentages with Arc sins (Ferguson, 1971). For clarity, however, we will report the data here in mean percentages.

Results

Our hypotheses predicted that the four groups of signers would repeat the utterances with unequal accuracy. We also predicted that the subjects would repeat the ASL sentences with greater accuracy than they would repeat the scrambled-ASL sentences and that they would recall the stimuli more accurately than they would shadow the same stimuli. The results support the first two, but not the last, hypotheses. The results demonstrate, first, that the greater the number of years that deaf signers have used sign language, the greater the accuracy with which they can repeat ASL sentences and scrambled-ASL sentences. The results also demonstrate that the order of signs in

ASL sentences facilitates signers' ability both to shadow and recall ASL sentences. Last, the results demonstrate that accurate recall of ASL utterances is a more difficult task than accurate shadowing of the same stimuli.

Sentences and Scrambled Sentences

Figure 1 shows the significant main effect of removing sign order from ASL sentences on the signers' repetition accuracy ($df = 1, 40$; $F = 13.19$; $p < .001$). The signers accurately repeated a greater percentage of the ASL sentences (85%) as compared to the scrambled-ASL sentences (83%). We originally predicted an interaction between the age at which signers first learned to sign and their ability to repeat ASL sentences and scrambled sentences. We thought that signers who had signed for only a few years would repeat the sentences and scrambled sentences equally well, but that signers who had signed for most of their lives would repeat the sentences more accurately than the scrambled sentences. The data do not support our hypothesis. However, the data suggest that sign order plays a facilitative role in signers' ability to repeat ASL sentences in the tasks of shadowing and recall.

Insert figure 1 about here

Shadowing and Recall tasks

Figure 2 shows the significant main effect of the repetition tasks, shadowing and recall ($df = 1, 40$; $F = 490.21$; $p < .00001$). Overall, the subjects shadowed the utterances with greater accuracy (92%) than they recalled the same stimuli (76%). Contrary to our expectations, shadowing single utterances was not more difficult than accurate recall of the same

stimuli. We hypothesized that doing two things at once, watching and signing a sentence simultaneously, would be more difficult than doing one thing after another, successively watching and then signing a sentence. Although recall may play a role in accurate shadowing, the subject can offset limited recall by faster or closer shadowing, that is, shadowing behind the stimulus at a length of a phrase or single sign.

Groups

Figure 3 shows the significant main effect of grouping the subjects by the age at which they first began to learn to sign ($df = 3, 40$; $F = 42.54$; $p < .00001$). Although the performance of group one may be attenuated by ceiling effects (94%), group one, signers who first learned to sign at birth, performed with greater accuracy than group two (90%) who first learned to sign at five years of age when they first attended school ($t = 2.07$; $df = 82$; $p < .05$). As we predicted, groups three and four who first began to sign between 13 and 15 years of age and after 18 years of age performed less accurately than the first two groups (80% and 73% respectively).

Groups and Tasks

Figure 4 shows the significant interaction of the groups with the shadowing and recall tasks ($df = 3, 40$; $F = 3.49$; $p < .05$). All the groups shadowed the utterances more accurately than they recalled the same stimuli. However, as Figure 4 shows, the disparity between the groups' shadowing and recall accuracy was much greater for groups three and four than it was for groups one and two. The effect may be artificially created by a ceiling effect for groups one and two. The shadowing performances of groups one and two were identical (98%), whereas group one's recall accuracy (89%) was significantly greater than that of group two (83%; $t = 3.428$; $df = 1, 40$; $p < .01$).

Insert figure 4 about here

Discussion

The quantitative results of our experiment provide five important findings. First, the results replicate and extend earlier research demonstrating that deaf signers show considerable variability in ASL fluency (Mayberry, 1979). Second, the results demonstrate that ASL fluency is a function, in part, of the number of years a person has signed (Hatfield, 1980). Third, the results show that accurate recall of utterances is a more sensitive measure of ASL fluency than accurate shadowing of utterances. Fourth, the quantitative data replicate earlier research demonstrating that the order of signs in ASL sentences plays a facilitative role in ASL-sentence comprehension (Tweney & Heiman, 1977). However, the data do not support our hypothesis that scrambling sign order in ASL sentences reduces the ability of native-ASL signers to shadow and recall ASL utterances more so than that of nonnative signers. Last, the shadowing performance of the native-ASL signers on the ASL sentences and scrambled sentences is very similar to speech data that Lackner (1980) reported for native-English speakers shadowing grammatical and ungrammatical English sentences. In addition to the quantitative data, our experiment yielded a great deal of qualitative data in terms of errors. We are analyzing the subjects' error patterns in relation to their accuracy scores. The error analysis will give us more descriptive insight into the phenomenon of fluency in sign language.

Our results do not demonstrate that age of acquisition is a critical or determining factor in ASL fluency. Because the forty-four subjects in our experiment were all young adults between the ages of 20 to 38, our results show only that the greater the number of years a person has signed, the greater the accuracy with which he can repeat ASL sentences. Clearly, we need to replicate our experiment with signers who are older than 38 years of age.

For some time now researchers and educators have known on either an intuitive or observational basis that the sign language skills of deaf adults are quite heterogeneous. The results of much research are beginning to converge. Until we have evidence to the contrary, we must assume that the factors that nurture and guide fluency in spoken language also nurture and guide fluency in sign language. Although there are multiple and fruitful comparisons that researchers can and must make between first and second-language learning in both spoken and sign language, there are important differences between the two situations. Thus future research must carefully elucidate the similarities and differences among the diverse situations in which deaf children learn language. In particular, future research must examine the similarities and differences among: (1) learning sign language as a first or second language in childhood; (2) learning sign language as a second language in adulthood; and (3) delayed first-language learning, be it signed or spoken.

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Footnotes

1. Hatfield (1980) speculates that the results of the dominant ASL group are due to their strong identification with the deaf community during early adolescence, an identification that included a rejection of everything to do with the hearing world, including English.
2. We thank Frank Woosley for his superb signing skill; never have scrambled-ASL sentences looked so normal.
3. We thank Keith Cagle and Sharon Lott for their patient and exacting help in transcribing the subjects' performance.

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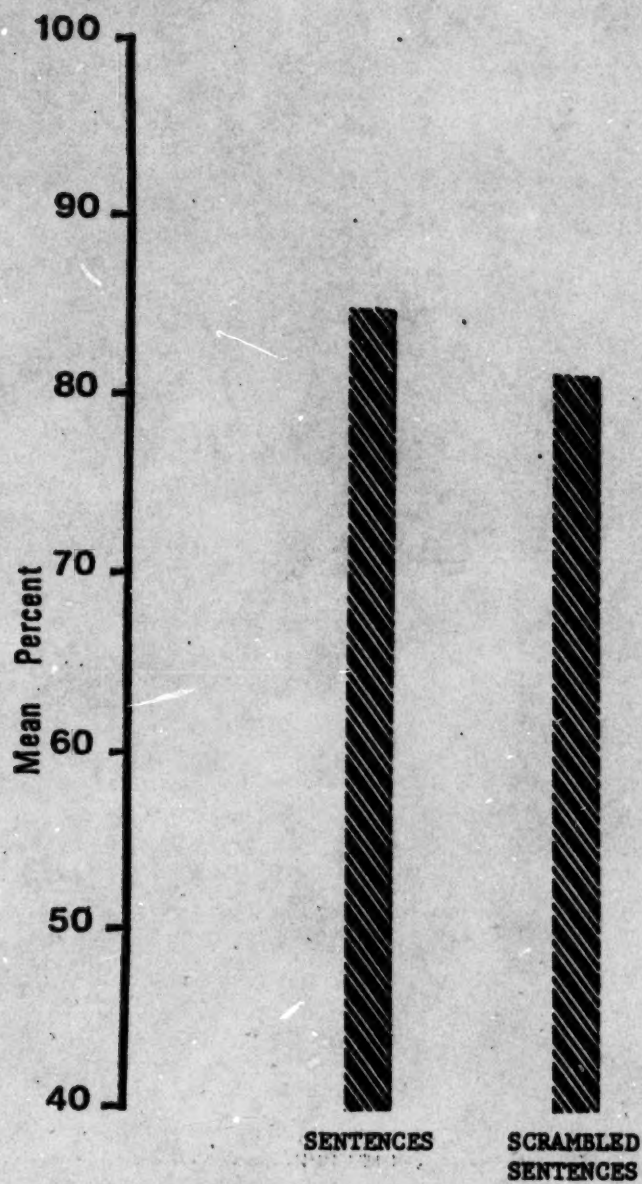


Figure 1. The subjects' mean performance on the ASL sentences and scrambled-ASL sentences.

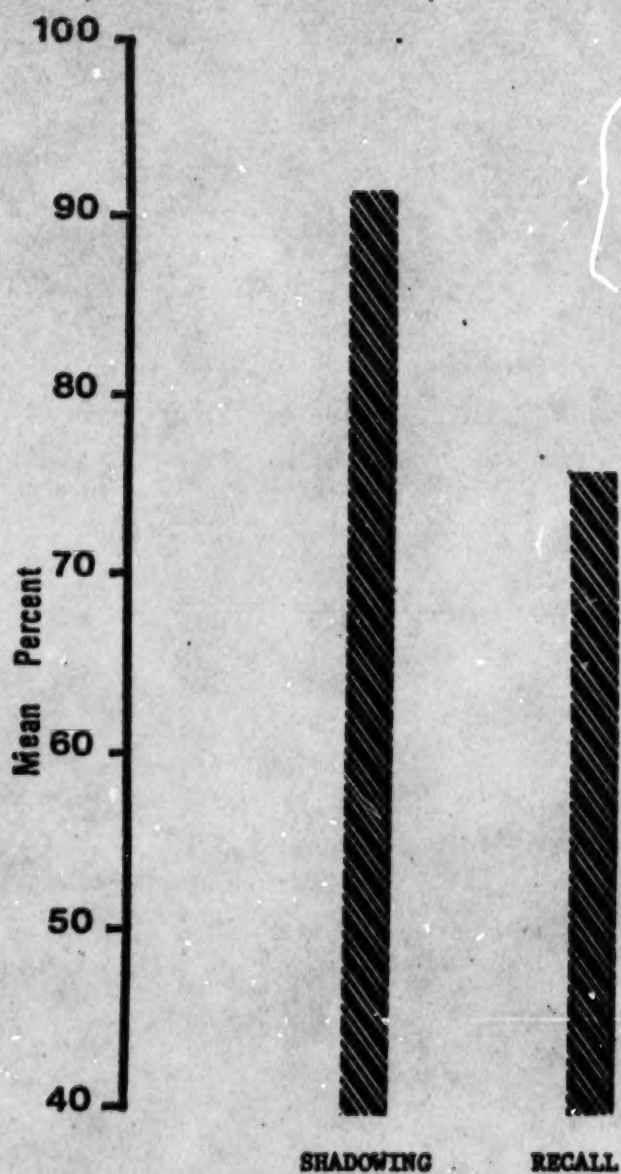


Figure 2. The subjects' mean performance on the shadowing and recall tasks.

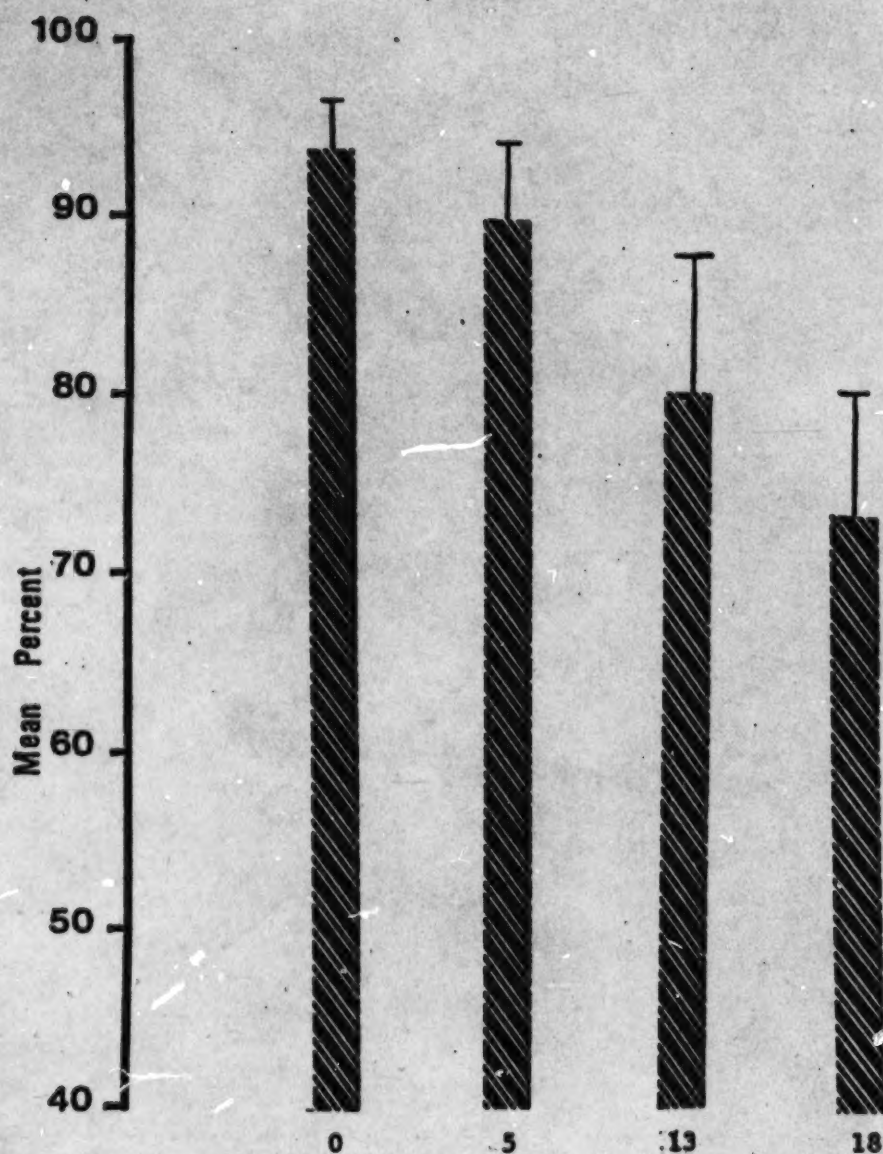


Figure 3. The mean performance and standard deviations of the subjects grouped by the age at which they first began to learn sign language.

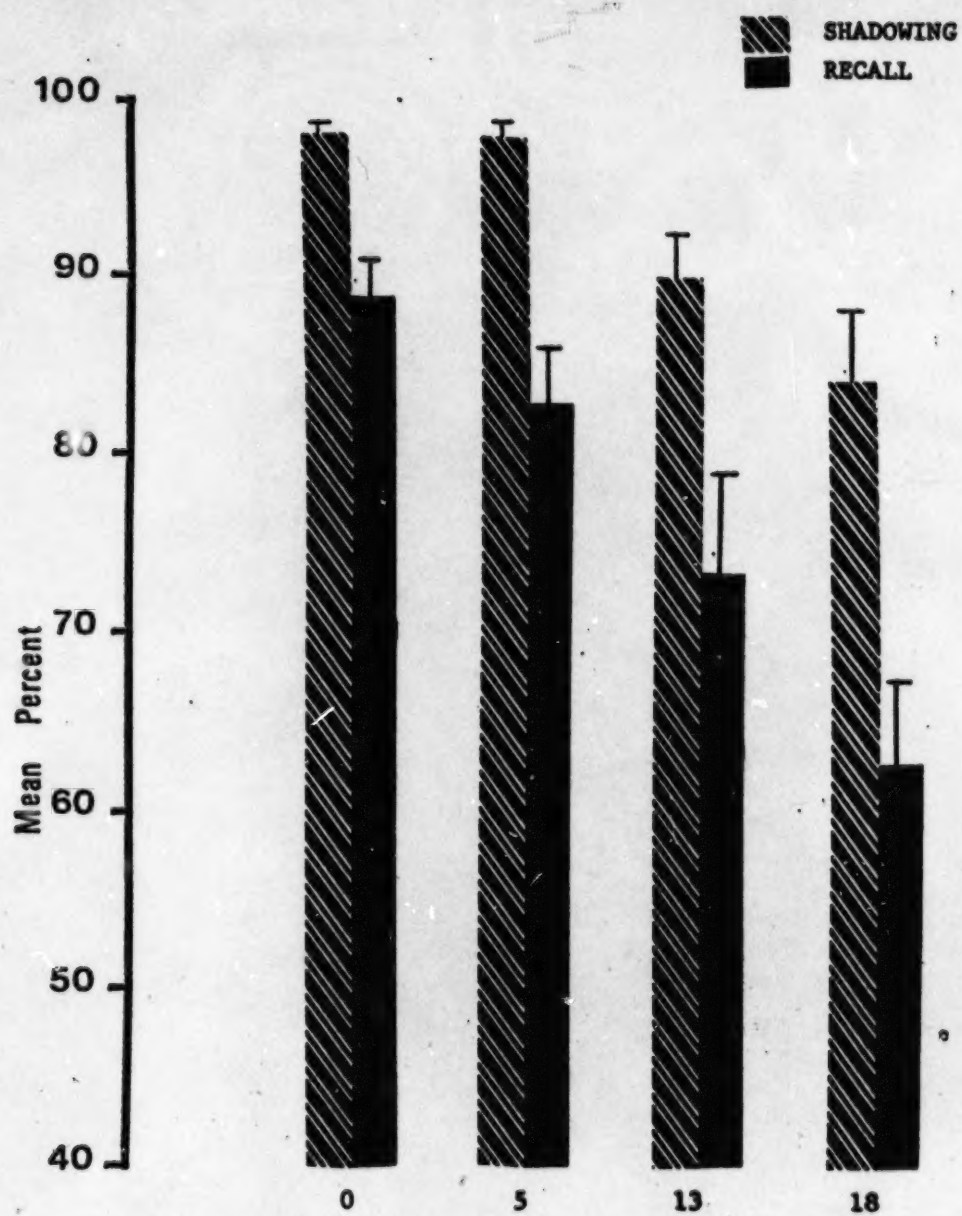


Figure 4. The groups' mean performance and standard deviations on the shadowing and recall tasks.